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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/911,155	07/23/2001	Primit Parikh	P0164US7	4496

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EXAMINER

HU, SHOUXIANG

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 03/27/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/911,155

Applicant(s)

PARIKH ET AL.

Examiner

Shouxiang Hu

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 February 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-51 is/are pending in the application.
- 4a) Of the above claim(s) 9-13,25-27,29-42,50 and 51 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8,14-24,28 and 43-49 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restriction

1. Claims 9-13, 25-27, 29-42 and 50-51 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), there being no allowable generic or linking claim. The election was made in Paper No. 5. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claim Objections

2. Claims 2, 3, 6, 15, 19, 20 and 47-49 are objected to because of the following informalities/defects:

3. Claims 2, 19 and 47 recite the subject matter that the junction barrier potential varies with the Schottky metal work function. However, these claims are directed to a final structure of a diode. With any given junction, the junction barrier potential in the diode is a fixed value. Accordingly, the term of "varies" recited in these claims should read as --depends--.

4. The term of "being generally equal to" recited in claim 3 should read as --being approximately equal to--, for being consistent with what is described in the specification (see page 9, line 25-29).

5. Claims 6, 22 and 49 recite Ge as one of the Schottky metals for the instant invention, which is inconsistent with what is described in the specification (see page 10, lines 12-17).
6. Claim 15 recites the subject matter of a heavily doped semiconductor layer having an unpinning surface potential. However, according to the specification (see page 7, lines 18-23), the unpinning surface potential is associated with the surface of the lightly doped semiconductor layer (13), not the heavily doped one (12).
7. The term of "of claim 15" in claim 20 should read as --of claim 18--.
8. The term of "the said" in claim 48 (line 3) should read as --said--.
Appropriate correction is required.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 1-5, 7, 8, 14-21, 23, 24, 28 and 43-48, insofar as the claim objections set forth above being properly overcome, are rejected under 35 U.S.C. 102(b) as being anticipated by Mohammad et al. ("Mohammad"; Electronics Letters, March 14, 1996, V32, N6, pages 598-599).

Mohammad discloses a group III nitride based diode (Fig. 1), comprising: an n-GaN layer on an n+ GaN layer over a sapphire substrate; a Schottky metal (Pt/Ti/Au)

and the n- GaN layer form a junction, and an ohmic contact to n+ GaN layer, wherein the junction is a substantially ideal Schottky type junction with substantially no interface traps (see the abstract). And, it is noted that, in such a substantially ideal junction, the junction barrier potential is inherently unpinned by surface traps and is inherently dependent upon the work function of the Schottky metal, according to the well recognized basic characteristics of a Schottky diode (e.g., see Ng, Complete Guide to Semiconductor Devices, McGraw-Hill, Inc., 1995, pages 30-39).

Regarding claims 7, 8, 23 and 24, the doping concentrations for the n- and n+ GaN layers in Mohammad (as shown in Fig. 1) are within the concentration ranges defined in the claims of the instant invention.

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. Claims 6, 22 and 49, insofar as the claim objections set forth above being properly overcome, are rejected under 35 U.S.C. 103(a) as being unpatentable over Mohammad et al. ("Mohammad"; Electronics Letters, March 14, 1996, V32, N6, pages 598-599), as applied to claims 1-5, 7, 8, 14-21, 23, 24, 28 and 43-48 above, in view of Binari et al. ("Binari"; Electronics Letters, May 26, 1994, V30, N11, pages 909-911).

The prior art reference of Mohammad is discussed as applied to claims 1-5, 7, 8, 14-21, 23, 24, 28 and 43-48 above.

Although Mohammad does not expressly disclose that the Schottky metal can also be a metal such as Ti, one of ordinary skill in the art would readily recognize that Ti can be used as the Schottky metal for desirably reducing the Schottky barrier height, due to its low work function, as evidenced in Binari (see the abstract).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the Ti Schottky metal of Binari into the group-III nitride-based diode of Mohammad, so that a diode with a desirably lowered Schottky barrier height would be achieved.

Conclusion

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Reference W is cited as being related to a Schottky diode structure.

14. Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722 or 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

Art Unit: 2811

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Shouxiang Hu** whose telephone number is **(703) 306-5729**. The examiner can normally be reached on Monday through Thursday from 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Tom Thomas**, can be reached on **(703) 308-2772**. The appropriate fax phone number for the organization where this application or proceeding is assigned is **(703) 308-7724**.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is **(703) 308-0956**.



Shouxiang Hu

March 21, 2002